CLAIMS

1. A converter for converting thermal energy into electrical energy by causing magnetic particles to circulate in said converter to induce electric current in one or more coils of electric wires, said converter comprising:

a) A main circuit, comprising:

a.1) A Heat Absorbing Container (HAC), having an inlet, connected to the first end of an inlet conduit, and a first outlet, connected to a first end of an outlet conduit; wherein said inlet conduit, said outlet conduit, and said HAC initially contain ferrofluid and carrier gas and said HAC is designed to absorb heat energy from an external heat source to heat said ferrofluid and said carrier gas to a first temperature (T1), at a first pressure (P1);

a.2) An elongate Heat Dissipating Container (HDC) initially filled with ferrofluid and carrier gas, having an inlet, connected to the second end of said outlet conduit, and an outlet connected to the second end of said inlet conduit; wherein said HDC is designed to dissipate heat to an external heat sink, thereby cooling said ferrofluid and said carrier gas contained therein to a second temperature (T2), lower than T1, at a second pressure (P2);

b) A reservoir container, connected by a conduit to the outlet of said HDC; said reservoir container designed to further cool the ferrofluid at the outlet of said HDC and to regulate the operating conditions in

said converter such that the relationship between T1 and P1 remains within the desired range inside said HAC and said ferrofluid exits said HAC as ferrogas while passing from said HAC to said outlet conduit and such that the relationship between T2 and P2 assures full condensation of the ferrogas to ferrofluid at the outlet of said HDC; said regulation accomplished by allowing exchange of ferrofluid stored in said reservoir container with said main circuit such as to lower, or to raise, as required, the overall pressure in said main circuit;

c) valves, for timely opening and closing said first outlet of said HAC and said outlet of said HDC and the inlet/outlet of said reservoir container;

d) a first one-way valve, connected at said inlet of said HAC for allowing ferrofluid to flow only in a direction from said outlet of said HDC to the inlet of said HAC, as a result of the difference in pressure in said HAC and in said HDC;

e) a second one-way valve, connected at said inlet of said HDC for allowing ferrogas to flow only in a direction from said first outlet of said HAC to the inlet of said HDC, as a result of the difference in pressure in said HAC and in said HDC;

f) control means, for timely operating said valves;

g) magnetic field generation elements, for generating magnetic fields around selected sections of said inlet conduit and said outlet conduit; said magnetic fields having direction and sufficient strength such that the individual magnetic fields of essentially all of said magnetic particles will be aligned by said generated fields when said particles move through said selected sections of said conduits; and

h) electricity conducting wires, coiled around said selected sections of said inlet conduit and said outlet conduit, wherein electric current is induced in the coils of said wires by said aligned magnetic fields of said magnetic particles moving through said coils of said wires.

2. A converter according to claim 1, wherein the cross-sectional area of the HAC is larger than the cross-sectional areas of the outlet conduit, the inlet conduit, and the HDC.

3. A converter according to claim 1, wherein the reservoir container has separate inlet and outlet valves.

4. A converter according to claim 1, wherein part of the inlet conduit has been routed such that it is connected to the outlet conduit above and below the selected section of said outlet conduit; thereby forming a section of conduit that is common to both said input conduit and said

output conduit, wherein said common section is the selected sections of both said input conduit and said output conduit and the electricity conducting wires are coiled around said common section of conduit.

5. A converter according to claim 1, further comprising:

a) a booster container comprising a booster inlet connected to a second outlet of the HAC and a booster outlet;

b) a booster conduit whose first end is connected to said booster outlet and whose second end is connected, through a one-way valve that opens as a result of the pressure exerted thereon by the ferromixture in said booster conduit, to the midsection of said HDC;

c) valves located at said second outlet of the HAC and said booster outlet, the activation of each of which is controlled by the controller.

d) Magnetic field generation elements, for generating magnetic fields around selected sections of said booster conduit; said magnetic fields having sufficient strength and being orientated such that the individual magnetic fields of essentially all of said magnetic particles will be aligned when said particles move through said selected sections of said booster conduit; and

e) Electricity conducting wires, coiled around said selected sections of said booster conduit, wherein electric current is induced in the coils of

said wires by said aligned magnetic fields of said magnetic particles moving through said coils of said wires.

6. A converter according to claim 5, wherein part of the inlet conduit and part of the outlet conduit have been routed such that they are connected to the booster conduit above and below the selected section of said booster conduit; thereby forming a section of conduit that is common to said input conduit, said output conduit, and said booster conduit; wherein said common section is the selected sections of said input conduit, said output conduit, and said booster conduit and the electricity conducting wires are coiled around said common section of conduit.

7. A converter according to claim 1, further comprising a by-pass conduit, the first end of which is connected to the HAC through a valve and the second end of which is connected directly to the HDC; wherein the purpose of said by-pass is to allow control of the velocity of flow of the circulating ferrofluid/ferrogas/ferromixture in the main circuit of said converter; said control including maintaining said velocity within a desired operating range, reducing said velocity, or completely stopping the circulation.

8. A converter according to claim 7, wherein the first end of the by-pass conduit is preferably located closer to the outlet of the HAC than to its

inlet, and the second end of said by-pass conduit is preferably located closer to the outlet of the HDC than to its inlet.

9. A converter according to claim 5, in which the HAC is divided into two longitudinal sections, an inlet section connected to an outlet section through a one-way valve or filter, and the HDC is divided into two sections, an inlet section connected to an outlet section through a one-way valve; wherein, when the pressure in the respective inlet section exceeds the pressure in the respective outlet section, the respective valve opens allowing ferrofluid/ferrogas/ferromixture to flow from said respective inlet section to said respective outlet section.

10. A converter according to claim 5, provided with one or more optical arrangements located near one or more of the valves and/or in one or more of the conduits; said optical arrangement for collecting light rays and for focusing the collected light rays such as to raise the temperature of the ferromixture at the location of said optical arrangement, thereby increasing the velocity of the magnetic particles that are suspended in said ferromixture.

11. A converter according to claim 10, in which the optical arrangement comprises a window that is formed in the walls of the conduit.

12. A converter according to claim 11, in which the window comprises an activated shutter, which is opened and closed by the control system either in synchronization with the operation of the valves or according to conditions in the vicinity of said window.

13. A converter according to claim 10, in which the optical arrangement comprises a heliostat.

14. A converter according to claim 1, wherein the HAC is positioned on the top side of the wind wing of a sea wave energy converter and the HDC is installed on the bottom side of said wind wing.

15. A method for converting thermal energy into electrical energy in a converter whose main circuit is initially filled with ferrofluid and carrier gas; said main circuit comprising:

a) a Heat Absorbing Container (HAC), designed and located such that it is capable of absorbing heat from an external heat source, said HAC having an inlet, connected to the first end of an inlet conduit, and a first outlet, connected to a first end of an outlet conduit;

b) an elongate Heat Dissipating Container (HDC), designed and located such that it is capable of dissipating heat to an external heat sink,

said HDC having an inlet, connected to the second end of said outlet conduit, and an outlet connected to the second end of said inlet conduit;

c) valves;

d) Control means, for timely operating said valves;

e) magnetic field generation elements, for generating magnetic fields around selected sections of the inlet conduit and the outlet conduit; said magnetic fields having sufficient strength and being orientated such that the individual magnetic fields of essentially all of the magnetic particles will be aligned by said generated fields when said particles move through said selected sections of said conduits; and

f) electricity conducting wires, coiled around selected sections of said conduits;

wherein, by controlling the local temperature and pressure at different locations in said main circuit, magnetic particles initially suspended in said ferrofluid will be made to circulate in a closed-loop in said main circuit, thereby inducing an electric current in the coils of said wires when the aligned magnetic fields of said magnetic particles move through said coils of said wires.

16. A method according to claim 15, wherein the electricity is generated by the following steps:

a) allow heat to be absorbed by the HAC, from an external heat source, thereby to increasing the temperature of the ferrofluid and carrier gas and the pressure inside said HAC;

b) open valves at the first and second ends of the outlet conduit, thereby allowing the high pressure carrier gas to push ferrofluid out of said HAC, said ferrofluid changing phase to ferrogas and releasing the suspended magnetic particles, which are carried through said outlet conduit towards said HDC by the ferromixture and carrier gas;

c) utilize the high pressure in said HAC and said outlet conduit to force ferromixture, into the HDC, thereby raising the pressure of the gas in said HDC;

d) cooling said ferromixture in said HDC, thereby condensing the ferrogas in said ferromixture to ferrofluid;

e) close said valves at said first and second ends of said outlet conduit and open valves at the first and second ends of the inlet conduit, when the difference in pressure in said HDC and in said HAC reaches a predetermined value, thereby allowing ferrofluid and carrier gas to be pushed from said HDC to said HAC through said inlet conduit;

f) commencing the next cycle of operation, by repeating steps a) to e); and

g) in each cycle, aligning the magnetic fields of said magnetic particles as they pass through selected sections of said inlet and said outlet

conduits, around which selected sections electricity conducting wires are coiled;

thereby inducing electric currents in said coils of electricity conducting wires.

17. A method according to claim 15, wherein the converter additionally comprises one or more of the following:

a) a reservoir container, connected by a conduit to the outlet of the HDC;

b) a booster container comprising a booster inlet connected to a second outlet of the HAC and a booster outlet connected to the first end a booster conduit whose second end is connected, through a one-way valve to the midsection of said HDC;

c) a by-pass conduit, the first end of which is connected to said HAC through a valve and the second end of which is connected directly to said HDC, said by-pass allowing control of the velocity of flow of the circulating ferrofluid/ferrogas/ferromixture in the main circuit of said converter;

d) an HAC which is divided into two longitudinal sections, an inlet section connected to an outlet section through a one-way valve or one-way filter;

e) an HDC which is divided into two sections, an inlet section connected to an outlet section through a one-way valve; and

f) one or more optical arrangements located near one or more of said valves or near one or more of the areas where electricity is produced.

18. A method according to claim 17, wherein the electricity is generated by the following steps:

a) allow heat to be absorbed by the HAC, from an external heat source, thereby to increasing the temperature of the ferrofluid and carrier gas and the pressure inside said HAC;

b) open valves at the first and second ends of the outlet conduit, thereby allowing the high pressure carrier gas to push ferrofluid out of said HAC, said ferrofluid changing phase to ferrogas and releasing the suspended magnetic particles, which are carried through said outlet conduit towards said HDC by the ferromixture and carrier gas;

c) utilize the high pressure in said HAC and said outlet conduit to force ferromixture, into the HDC, thereby raising the pressure of the gas in said HDC;

d) cooling said ferromixture in said HDC, thereby condensing the ferrogas in said ferromixture to ferrofluid;

e) close said valves at said first and second ends of said outlet conduit and open valves at the first and second ends of the inlet conduit, when the difference in pressure in said HDC and in said HAC reaches

a predetermined value, thereby allowing ferrofluid and carrier gas to be pushed from said HDC to said HAC through said inlet conduit;

f) commencing the next cycle of operation, by repeating steps a) to e); and

g) in each cycle, aligning the magnetic fields of said magnetic particles as they pass through selected sections of said inlet and said outlet conduits, around which selected sections electricity conducting wires are coiled;

thereby inducing electric currents in said coils of electricity conducting wires.

19. A method according to claim 18, wherein the converter comprises a booster container comprising a booster inlet connected through a valve to a second outlet of the HAC and a booster outlet connected through a valve to the first end of a booster conduit whose second end is connected, through a one-way valve to the midsection of the HDC, said method comprising the additional steps of:

h) opening said valve at said booster outlet at step b);

i) open said valve at said first end of said booster conduit when the pressure difference between the gas in said booster container and said HDC reaches a predetermined value;

j) close said valve at said booster outlet at step e); and

k) close said valve at said first end of said booster conduit when the pressure difference between the gas in said booster container and said HDC reaches a predetermined value.

20. A method according to claim 18, wherein the converter comprises a by-pass conduit, the first end of which is connected to the HAC through a valve and the second end of which is connected directly to the HDC, said method comprising the additional step of opening said valve at the first end of said by-pass conduit when necessary, thereby reducing the difference in the pressures inside said HAC and said HDC thus changing the velocity of flow of the circulating ferrofluid/ferrogas/ferromixture in the main circuit of said converter.

21. A method according to claim 18, wherein the converter comprises one or more optical arrangements located near one or more of the valves, said optical arrangements comprising shutters, said method comprising the additional step of opening said shutter at an appropriate time to increase the localized temperature of the ferrofluid/ferrogas/ferromixture in the focal zone of said optical arrangement.